2020 Hypoxia Forecast

Modeling Workgroup Quarterly Call
8 July 2020

Isabella Bertani[1], Don Scavia[2], Aaron Bever[3], Joel Blomquist[4], Marjy Friedrichs[5], Lewis Linker[6], Bruce Michael[7], Rebecca Murphy[1], Gary Shenk[4], Jeremy Testa[1]

[1] UMCES
[2] University of Michigan
[3] Anchor QEA, LLC
[4] USGS
[5] VIMS
[6] EPA
[7] Maryland DNR

Chesapeake Bay hypoxia forecasting model

Driver:

Jan-May average
Susquehanna TN load

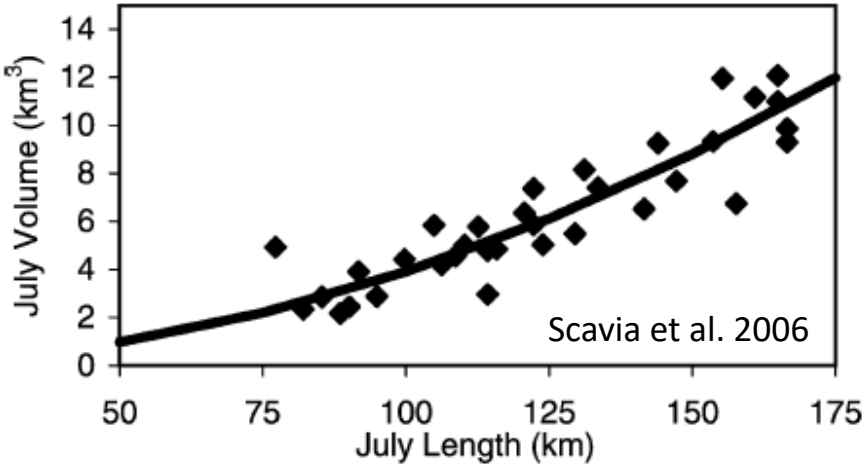
Calibration target:

Mean July hypoxic volume (HV)
([DO] < 2 mg/L)

Model output:

Average subpycnocline [DO] as a function of distance from TN source

V-L relationship



Hypoxic length = sum of all segments with [DO] < 2 mg/L

Hypoxic length → **hypoxic volume** through empirical V-L relationship

Calibration exercises

1. HV metrics:
Average July (km^3), Average Summer (km^3),
Total Annual (km^3 * days)

2. HV estimates
3 sets of interpolated estimates: **Murphy** et al. 2011, **Bever** et al. 2013 and **Zhou** et al. 2014

3. Load sources:
Sus, Pot, Sus+Pot, Sus+Pot+PS, All 9 RIM rivers,
All 9 RIM rivers + PS

4. Load time frames:
Oct-May (all possible combinations)
Oct-Jun (all possible combinations)

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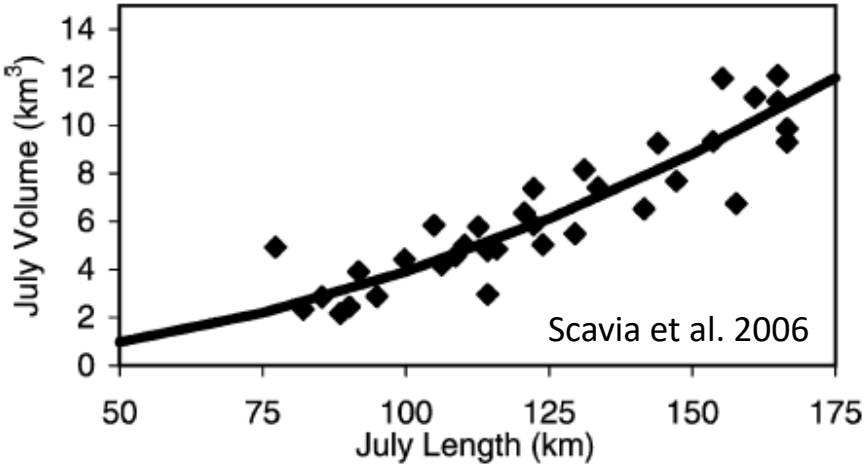

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Chesapeake Bay hypoxia forecasting model

Driver:

Jan-May average
~~Susquehanna TN load~~
All 9 RIM rivers + PS
TN load

Calibration target:

~~Mean July hypoxic volume (HV)~~
Total Annual HV
([DO] < 2 mg/L)

Model output:

Average subpycnocline [DO] as a function of distance from TN source

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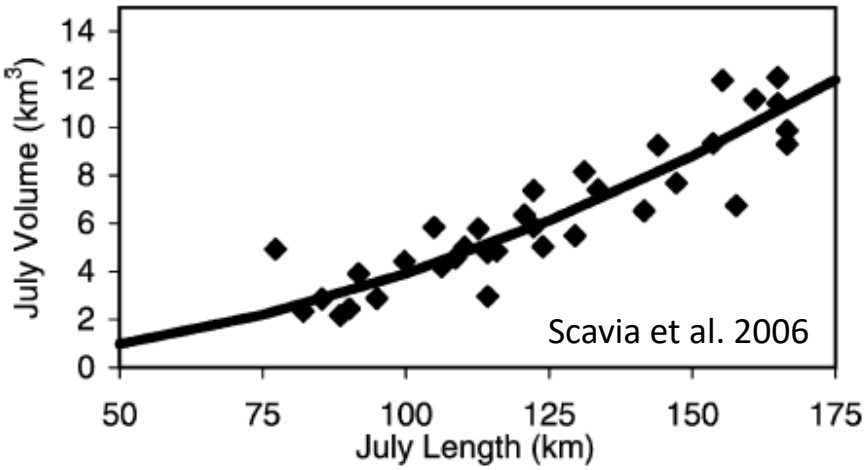
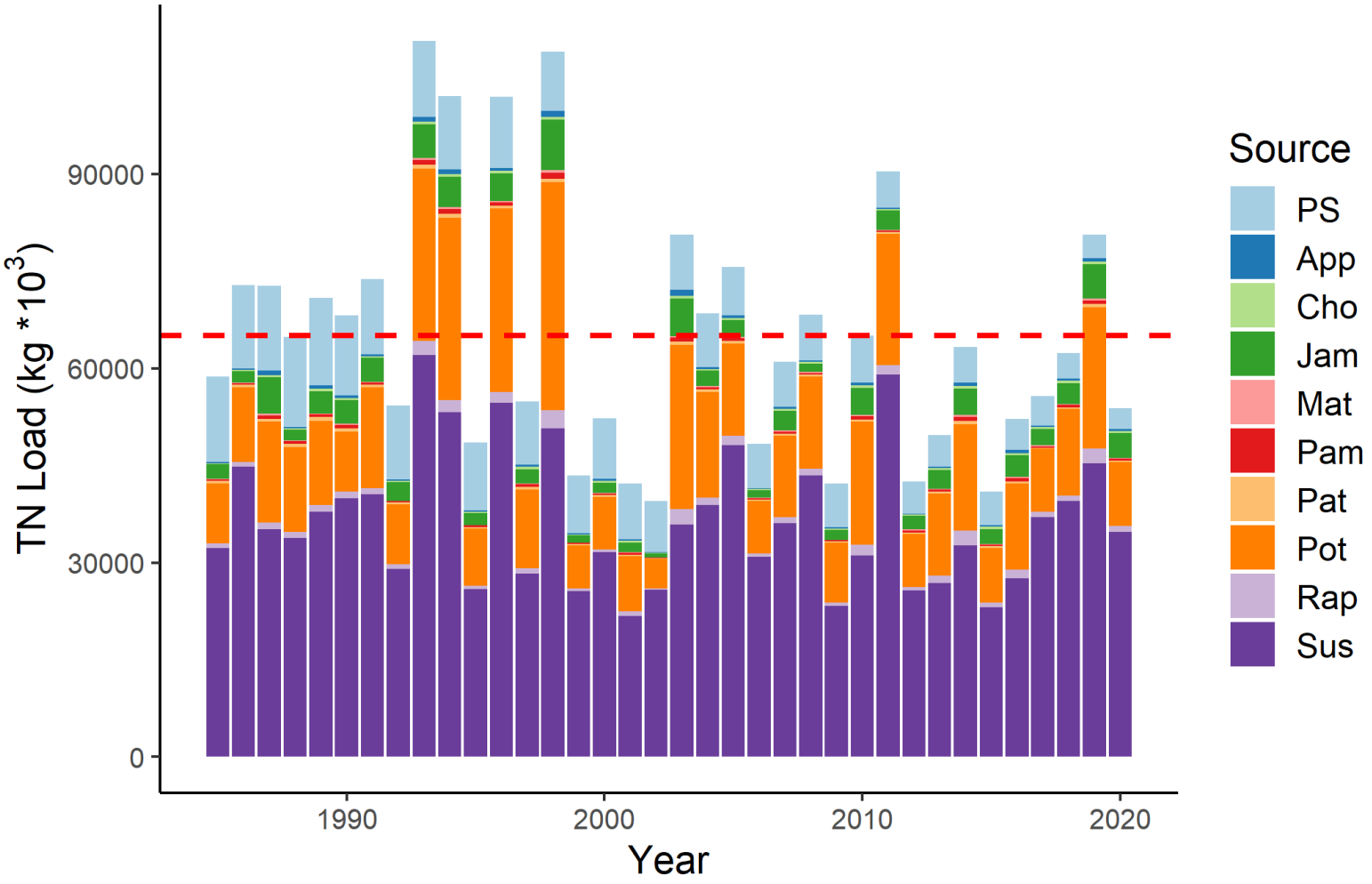
V-L relationship

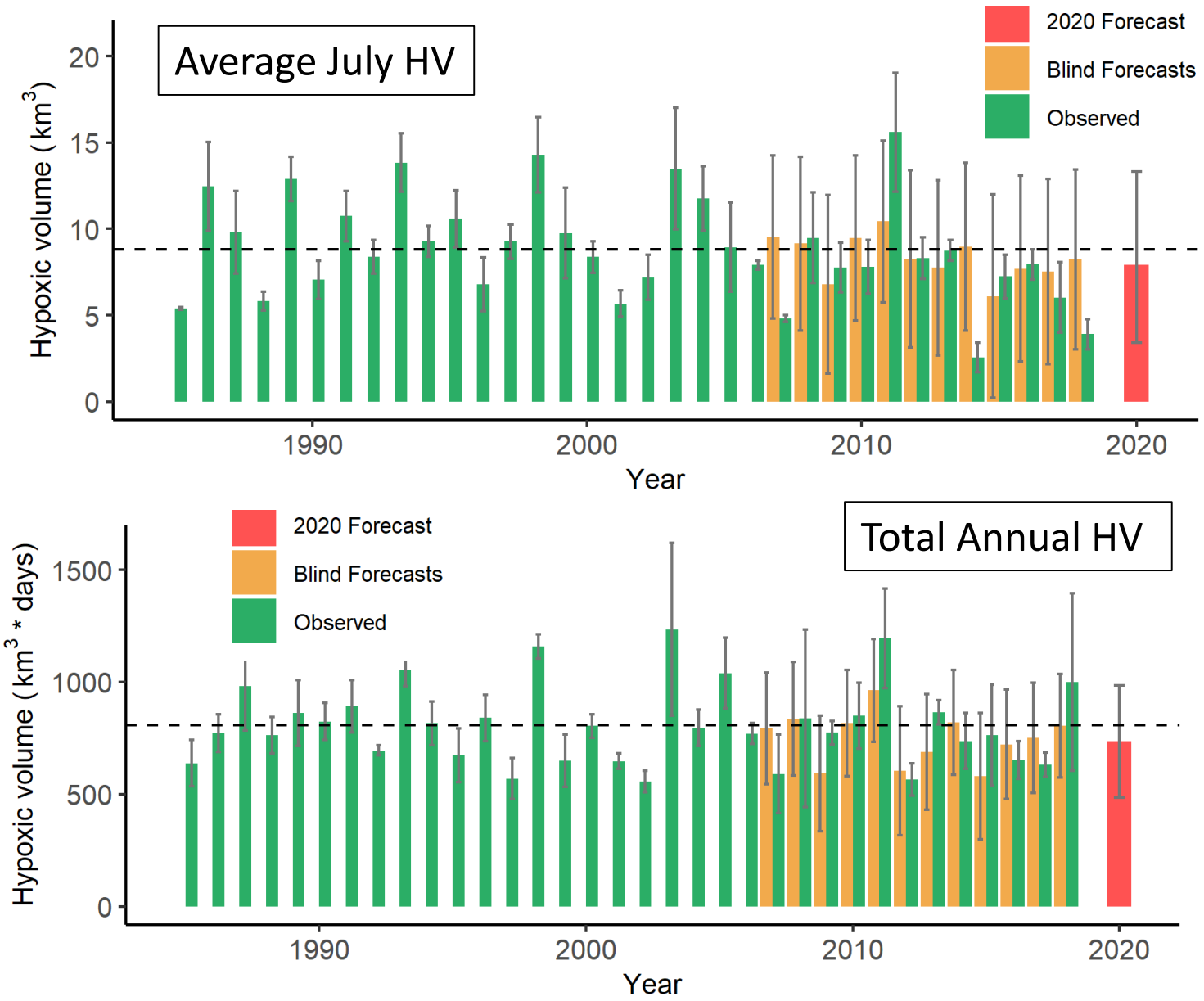


Hypoxic length → **hypoxic volume** through empirical V-L relationship

Jan-May TN Load by Source



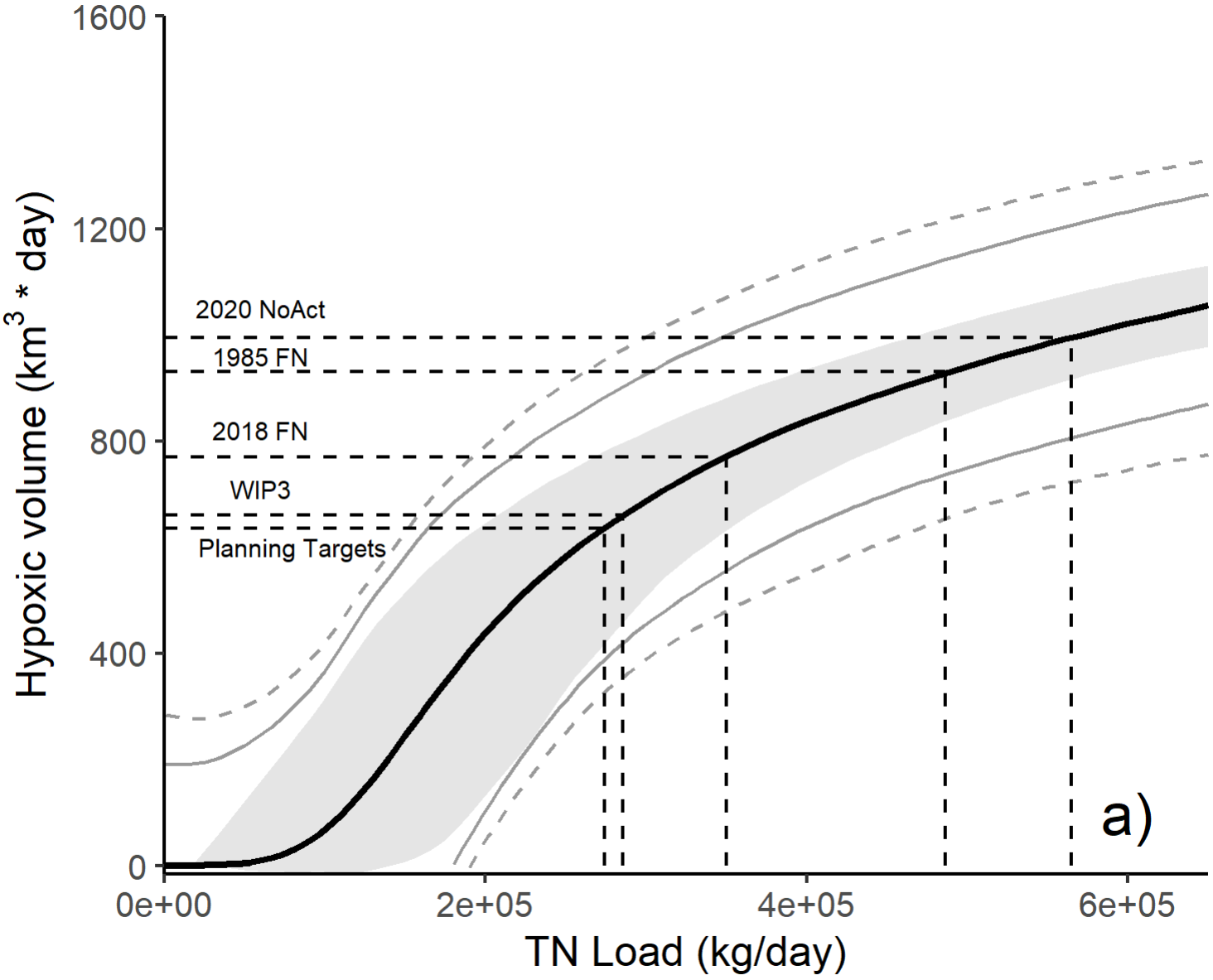
Blind forecasts and 2020 forecast



Potential future improvements

- Develop method to update forecast over the summer, potentially as a function of weather
- Estimate bioavailable portion of the TN load
- Assign different weights to loads from different months
- Assign load sources to different locations along the model`s spatial domain
- Revise Length-Volume relationship

HV-Load Response Curve



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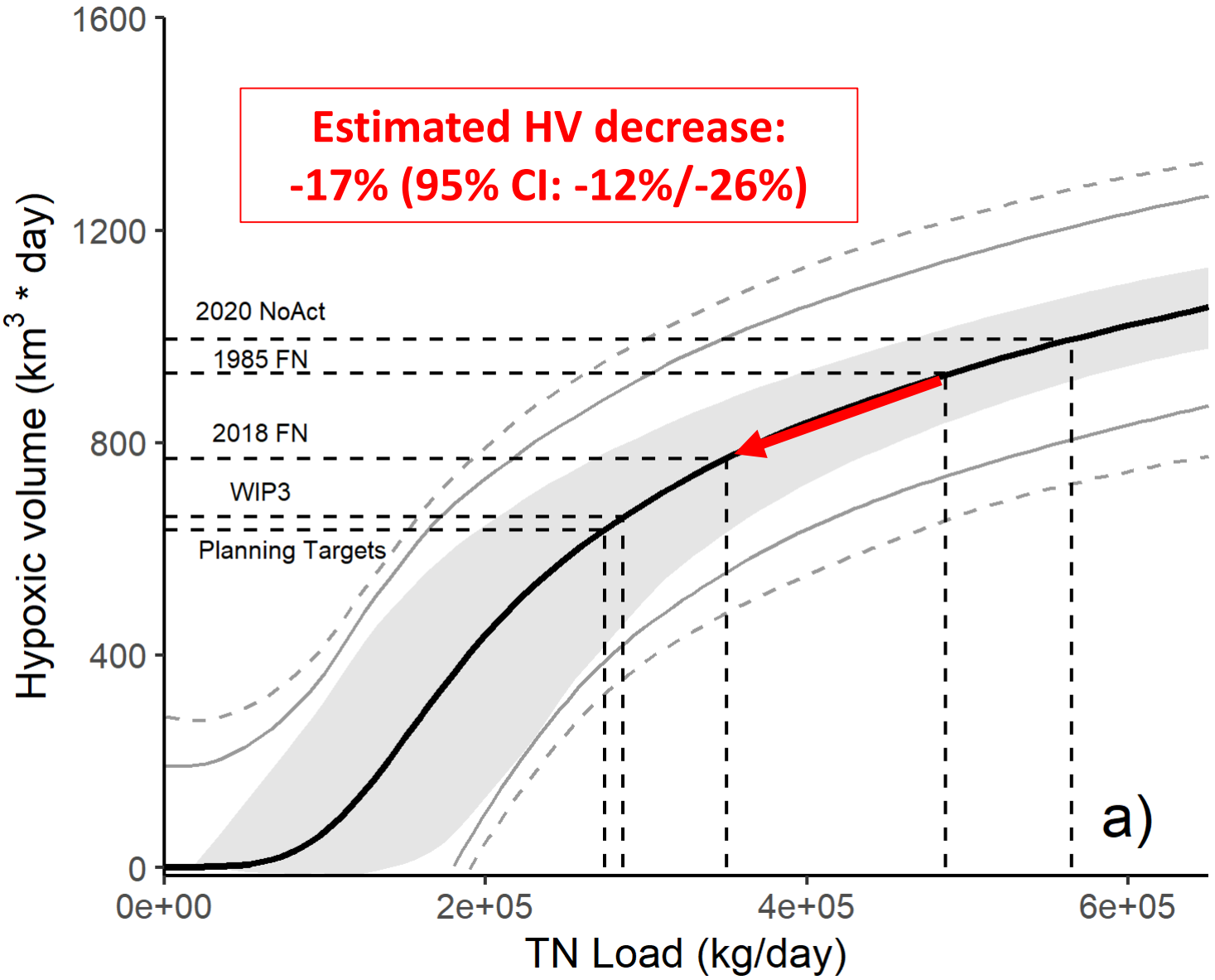

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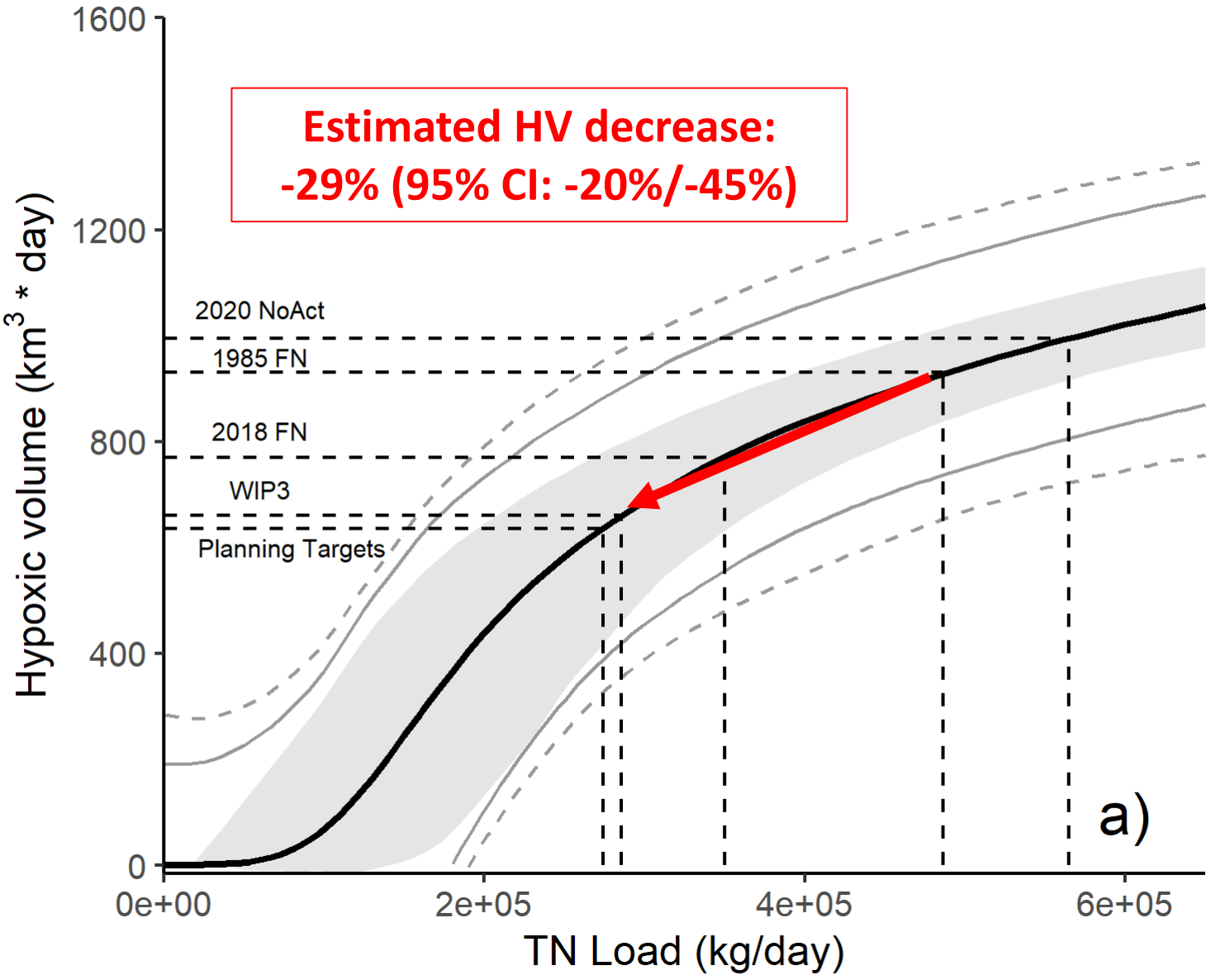
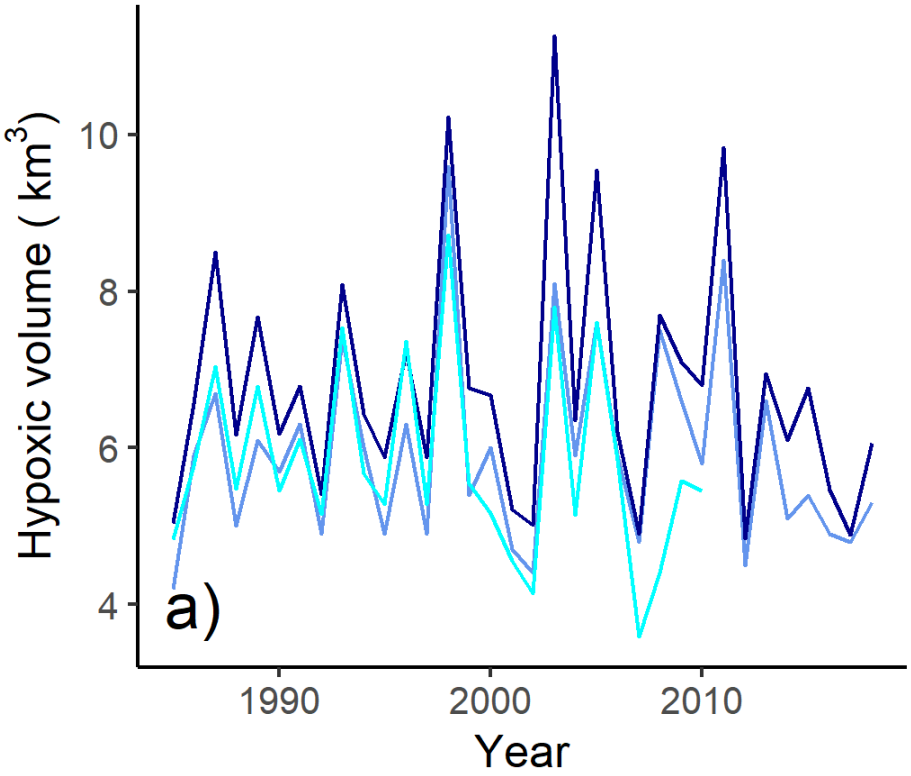
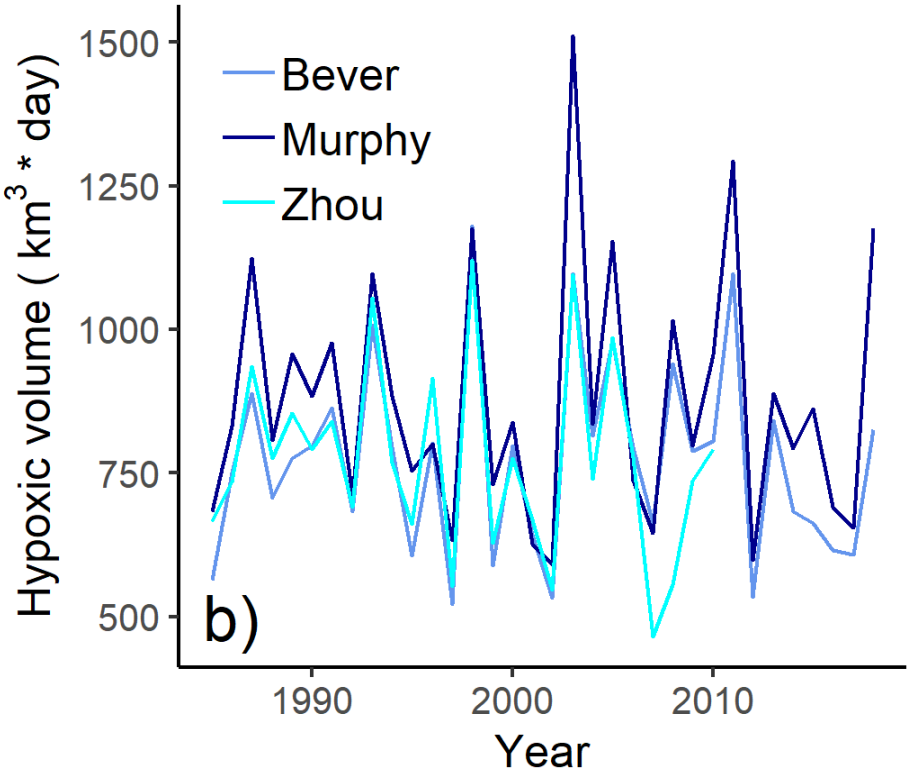


HV metrics and estimation methods

Average Summer HV



Total Annual HV

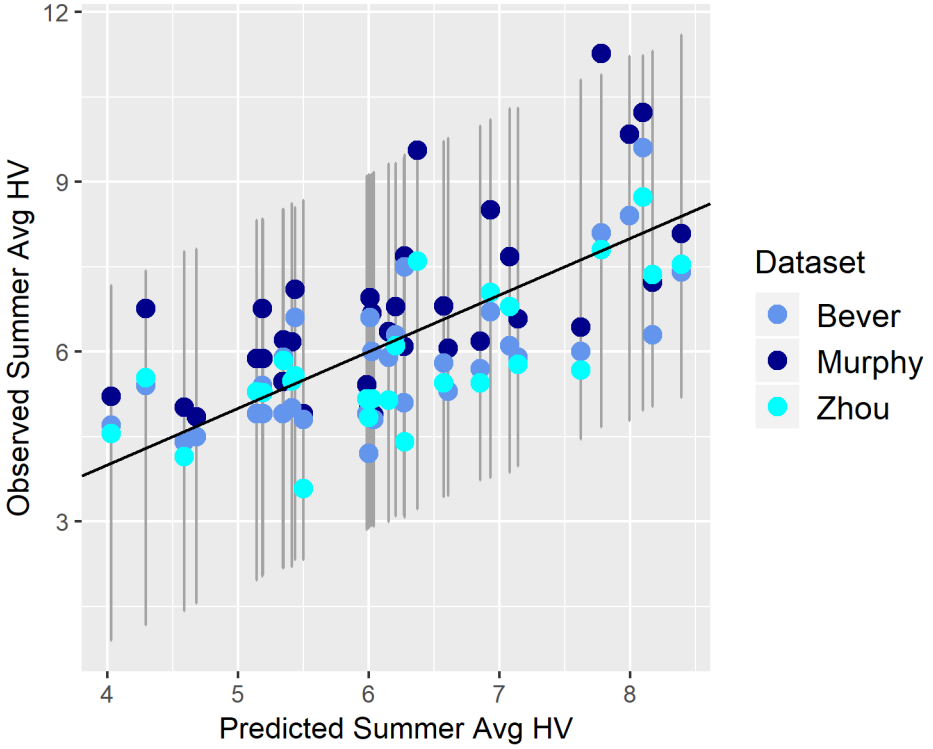


Bever et al.. 2013; **Murphy** et al., 2011; **Zhou** et al., 2014

Results – Best performing models

HV metric	Load Sources	Load Period	NSE	r2	RMSE	MAE
Avg Summer	9 RIMs + PS	Jan-Jun	0.40	0.52	1.11	0.88
Tot Annual	9 RIMs + PS	Jan-Jun	0.50	0.61	135	106

Average Summer HV



Total Annual HV